

**REMARKS****Summary of the Office Action**

In the Office Action, claims 2-4 and 7 were rejected under 35 U.S.C. § 112, second paragraph, as allegedly being indefinite for failing to particularly point out and distinctly claim the subject which Applicant regard as the invention. Claims 1-9 were rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,274,971 to *Sugimoto, et al.* ("*Sugimoto '971*"). Claims 1-3, 5, 6, 8 and 9 were provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over various combinations of claims in copending Application Nos. 09/867,759 and 09/794,151 (see the attached Appendix 1).

**Summary of the Response to the Office Action**

Applicants cancel claim 3 without prejudice or disclaimer and amend claims 1, 2, 4, and 7. Accordingly, claims 1, 2 and 4-9 are pending for further consideration. A terminal disclaimer is submitted with this Amendment to obviate that rejection based on obviousness type double patenting.

**35 U.S.C. § 112, second paragraph rejections**

Claims 2-4 and 7 were rejected under 35 U.S.C. § 112, second paragraph, as being indefinite. These rejections are respectfully traversed for at least the following reasons.

The Examiner is thanked for the helpful suggestions for rewriting claims 2, 4, and 7 to overcome any alleged indefiniteness and informalities. These suggestions have been incorporated into claims 2, 4, and 7.

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However, the Office Action's position that the "N" symbol needs to be defined in claims 2-4 is without merit. The symbol "N" in the claims is well understood by one of ordinary skill in the art to be the number of moles of a particular compound. Applicant respectfully disagrees that the "N" symbol needs to be defined in the claims as the number of moles, for the same reason that the symbol "Li" does not need to be defined as Lithium. Contrary to the assertion in the Office Action, the "N" symbol characterization is sufficiently definite and unambiguous. In fact, the Office Action states that it assumes that the symbol "N" is the number of moles in the compound, which is additional evidence of its ordinary meaning.

Accordingly, it is respectfully requested that the rejections under 35 U.S.C. § 112, second paragraph, be withdrawn.

**All Subject Matter Complies with 35 U.S.C. § 102(e)**

Claims 1-9 were rejected under 35 U.S.C. § 102(e) as being anticipated by *Sugimoto '971*. These rejections are respectfully traversed for at least the following reasons.

In regards to independent claim 1, Applicant respectfully submits that *Sugimoto '971* does not disclose or teach each and every feature of Applicants' claims and therefore the rejections under 35 U.S.C. § 102(e) should be withdrawn. Table 1 (attached) shows a conversion table that converts the mass weight percentages of table 1 of *Sugimoto '971*, into the molar weight percentages of the present application for comparison purposes. The conversion table shows that none of the disclosed embodiments/examples of *Sugimoto '971* anticipate the molar weight percentages as recited in claim 1 of the present application. For example, none of the first 18 embodiments of Table 1 of *Sugimoto '971* disclose or teach "10 to 15 mol% in total of at least one of alkaline metal components of Na, K, and Li in terms of Na<sub>2</sub>O, K<sub>2</sub>O, and Li<sub>2</sub>O, respectively; wherein the glaze layer contains the Li component and at least two alkaline metal

components among the Li, Na and K components, and satisfies the relationship:  $0.2 < \text{NLi}_2\text{O}/\text{NR}_2\text{O} < 0.5$ ,” as recited in claim 1. The 19th embodiment of Table 1 (which the *Sugimoto* '971 patent indicates is excluded from the invention) discloses  $\text{Na}_2\text{O}$  having a molar percentage of 11.8%. However, this embodiment fails to disclose other claimed features, including at least “35 to 55 mol% of a Si component,” as recited in claim 1. In addition, as shown in the attached Table 3 conversion from weight% to mol%, samples 118 and 120 include  $\text{Na}_2\text{O}$  in a range above 10%. However, samples 118 and 120 are also deficient in other aspects of the claimed invention. For example, samples 118 and 120 fail to disclose or teach a glaze layer including 35-55 mol% of  $\text{SiO}_2$ . In addition, none of the samples disclosed in Table 3 include at least the feature of the glaze layer containing the Li component and at least two alkaline metal components among the Li, Na and K components, and satisfying the relationship:  $0.2 < \text{NLi}_2\text{O}/\text{NR}_2\text{O} < 0.5$ , as recited in claim 1.

Similarly, newly amended independent claim 2 recites features not disclosed by *Sugimoto* '971. For example, *Sugimoto* '971 does not anticipate the claimed invention because each and every feature in claim 2 is not found in *Sugimoto* '971. Specifically, at least the features “10 to 15 mol% in total of at least one of alkaline metal components of Na, K, and Li in terms of  $\text{Na}_2\text{O}$ ,  $\text{K}_2\text{O}$ , and  $\text{Li}_2\text{O}$ , respectively; wherein the glaze layer contains the K component at least two alkaline metal components among the Li, Na, and K components, and satisfies the relationship:  $0.4 < \text{NK}_2\text{O}/\text{NR}_2\text{O} < 0.8$ ,” as recited in claim 2 are not found in *Sugimoto* '971.

*Sugimoto* '971 does not disclose or teach at least the above features of molar weight percentage of Na within the specified ranges as recited in claims 1 or 2. As pointed out in MPEP § 2131, a claim is anticipated by a prior art reference only if each and every element as set forth in the claim is found. *Verdegaal Bros. v. Union Oil Co. of California*, 2 USPQ2d 1051 (Fed.

Cir. 1987). Therefore, Applicants respectfully assert that the rejection under 35 U.S.C. § 102(e) should be withdrawn because *Sugimoto '971* does not teach or suggest each feature of independent claim 1 or independent claim 2, as demonstrated above. Additionally, it is further respectfully submitted that dependent claims 3-9 are also allowable insofar as they recite the patentable combinations of features recited in independent claim 1, as well as reciting additional features that further distinguish over the applied art.

### **Obviousness-type Double Patenting**

Claims 1-3, 5, 6, 8 and 9 were provisionally rejected under the judicially created doctrine of obviousness-type double patenting. Appendix 1 (attached) describes the specific rejection of each of the aforementioned claims. This rejection is respectfully traversed for at least the following reasons.

Concurrent with this Amendment, a Terminal Disclaimer pursuant to 37 C.F.R. § 1.321(c) is herewith filed to overcome the provisional obviousness-type rejections based on non-statutory double patenting grounds. Accordingly, it is respectfully requested that the non-statutory obviousness-type double patenting rejections be withdrawn.

### **CONCLUSION**

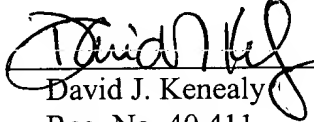
**EXCEPT** for issue fees payable under 37 C.F.R. § 1.18, the Commissioner is hereby authorized by this paper to charge any additional fees during the entire pendency of this application including fees due under 37 C.F.R. §§ 1.16 and 1.17 which may be required, including any required extension of time fees, or credit any overpayment to Deposit Account No. 50-0310. This paragraph is intended to be a **CONSTRUCTIVE PETITION FOR EXTENSION OF TIME** in accordance with 37 C.F.R. § 1.136(a)(3).

Attached hereto is a marked-up version of the changes made by the current Amendment.

The attached page is captioned "**Versions with markings to show changes made.**"

Respectfully submitted,

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**Version With Markings to Show Changes Made**

**IN THE CLAIMS:**

Claims 1, 2, 4, and 7 have been amended as follows:

1. (Amended) A spark plug comprising:

a central electrode;

a metal shell;

an alumina ceramic insulator disposed between the center electrode and the metal shell,

wherein at least part of the surface of the insulator is covered with a glaze layer comprising oxides,

wherein the glaze layer comprises:

1 mol% or less of a Pb component in terms of PbO;

35 to 55 mol% of a Si component in terms of SiO<sub>2</sub>;

15 to 35 mol% of a B component in terms of B<sub>2</sub>O<sub>3</sub>;

5 to 20 mol% of a Zn component in terms of ZnO;

0.5 to 20 mol% in total of at least one of Ba and Sr components in terms of BaO and SrO,

respectively; and

10 to 15 mol% in total of at least one of alkaline metal components of Na, K, and Li in terms of Na<sub>2</sub>O, K<sub>2</sub>O, and ~~[Li<sub>2</sub>]~~ Li<sub>2</sub>O, respectively;

wherein the glaze layer contains the Li component and at least two alkaline metal components among the Li, Na and K components, and satisfies the relationship:  $0.2 < \frac{N\text{Li}_2\text{O}}{N\text{R}_2\text{O}} < 0.5$  when the at least two alkaline metal components are taken as R, NR<sub>2</sub>O

is a total mol content of the at least two alkaline metals in terms of a composition formula

$R_2O$ , and  $NLi_2O$  is a mol content of the Li component in terms of  $Li_2O$ .

2. (Amended) A spark plug comprising:

a central electrode;

a metal shell;

an alumina ceramic insulator disposed between the center electrode and the metal shell, wherein at least part of the surface of the insulator is covered with a glaze layer comprising oxides,

wherein the glaze layer comprises:

1 mol% or less of a Pb component in terms of  $PbO$ ;

35 to 55 mol% of a Si component in terms of  $SiO_2$ ;

15 to 35 mol% of a B component in terms of  $B_2O_3$ ;

5 to 20 mol% of a Zn component in terms of  $ZnO$ ;

0.5 to 20 mol% in total of at least one of Ba and Sr components in terms of  $BaO$  and  $SrO$ , respectively; and

10 to 15 mol% in total of at least one of alkaline metal components of Na, K, and Li in terms of  $Na_2O$ ,  $K_2O$ , and  $Li_2O$ , respectively;

~~[Spark plug according to claim 1,]~~ wherein the glaze layer contains the K component and at least two alkaline metal components among the Li, Na, and K components, and satisfies the relationship:  $0.4 < NK_2O/NR_2O < 0.8$  when the at least two alkaline metals are taken as R,  $NR_2O$

is a total mol content of the at least two alkaline metal components in terms of a composition formula  $R_2O$ , and  $NK_2O$  is a mol content of the K component in terms of  $K_2O$ .

4. (Amended) The spark plug according to claim 1, wherein the glaze layer further comprises a B component and a Zn component in terms of  $B_2O_3$  and  $ZnO$ , respectively, in a total mol amount of  $N(B_2O_3 + ZnO)$ ,

the glaze layer further comprises at least one of: an alkaline earth metal component RE, RE being at least one selected from Ba, Mg, Ca and Sr, in terms of a composition formula REO; and an alkaline metal component R, R being at least one selected from Na, K and Li, in terms of a composition formula  $R_2O$ , in a total mol amount of  $N[(~~RO + R_2O~~)](REO + R_2O)$ , and

the ratio:  $N(B_2O_3 + ZnO)/N[(~~RO + R_2O~~)](REO + R_2O)$  is 1.5 to 3.0.

7. (Amended) The spark plug according to claim 1, which compromises one of: a terminal metal fixture and the center electrode as one body, in a through hole of the insulator; and a terminal metal fixture [~~and the center electrode~~] provided separately from the center electrode via a conductive bonding layer, in a through hole of the insulator, and

an insulation resistant value is 200 MΩ or more, which is measured by keeping the whole of the spark plug at about 500°C and passing a current between the terminal metal fixture and the metal shell via the insulator.



TABLE 1  
 conversion from wt% to mol%  
 of Table 1 from U.S. Patent 6,274,971

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
SiO <sub>2</sub>	60	16.0	25.0	30.0	35.0	40.0	28.0	28.0	28.0	28.0	28.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
Al <sub>2</sub> O <sub>3</sub>	102	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
B <sub>2</sub> O <sub>3</sub>	70	44.0	35.0	30.0	25.0	20.0	32.0	32.0	32.0	32.0	32.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0
Na <sub>2</sub> O	62	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	10.0
K <sub>2</sub> O	94	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	9.0	8.0	7.0	6.0	5.0	4.0	3.0	1.0
BaO	153	13.0	13.0	13.0	13.0	13.0	5.0	8.0	13.0	18.0	22.0	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
ZnO	81	17.5	17.5	17.5	17.5	17.5	25.5	22.5	17.5	12.5	8.5	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0
Total		100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

TABLE 1 of U.S. Patent 6,274,971 converted

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
SiO <sub>2</sub>	20.2	31.1	37.0	42.8	48.5	34.7	33.5	33.9	34.7	35.4	36.1	33.9	33.8	33.6	33.5	33.4	33.2	33.1	32.8
Al <sub>2</sub> O <sub>3</sub>	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
B <sub>2</sub> O <sub>3</sub>	47.7	37.3	31.7	26.2	20.8	33.9	32.8	33.2	33.9	34.7	35.3	33.4	33.2	33.1	33.0	32.8	32.7	32.6	32.3
Na <sub>2</sub> O	4.9	4.8	4.8	4.7	4.7	4.8	4.6	4.7	4.8	4.9	5.0	2.4	3.6	4.8	6.0	7.2	8.3	9.5	11.8
K <sub>2</sub> O	3.2	3.2	3.1	3.1	3.1	3.2	3.1	3.1	3.2	3.2	3.3	7.2	6.4	5.6	4.8	3.9	3.1	2.3	0.8
BaO	6.4	6.3	6.3	6.2	6.2	6.3	2.3	3.8	6.3	8.9	11.1	6.2	6.1	6.1	6.1	6.1	6.0	6.0	6.0
ZnO	16.4	16.1	16.0	15.8	15.7	16.0	22.6	20.2	16.0	11.7	8.1	15.8	15.7	15.7	15.6	15.6	15.5	15.4	15.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

**TABLE 3**  
conversion from wt% to mol%  
of Table 3 from U.S. Patent 6,274,971

**TABLE 3 of U.S. Patent 6,274,971**

	<wt%>																			
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
SiO <sub>2</sub>	15	20	25	35	45	51	26	21	32	27	30	35	25	28	29	28	27	26	29	28
Al <sub>2</sub> O <sub>3</sub>	1.9	0.1	1.6	1.2			1.7	3.7	1.9			0.3		1	1.5	1.2	0.1	0.8	1.5	0.9
B <sub>2</sub> O <sub>3</sub>	38	35	31	39	35	31	14	25	28	31	35	42	31	35	33	35	32	30	31	29
Na <sub>2</sub> O	3	6.1	4.5	6	6.2	6.6	5.7	4.9	5.2	4.1	4.8	6.3	2.2	3	4.3		8	9.5		10.3
K <sub>2</sub> O	4.2	3.5	6.2	3.5	3.8	3.1	6.8	5.1	6.7	4.2	5.5	4	2.1	4.6	5.7	6.7	5.1	6.1	5.3	10
Li <sub>2</sub> O																4.1			1.7	
CaO			0.5		0.9	1	0.4									0.2	0.1	1.6		1.3
BaO	17.8	19.9	10.9	8.2	4.2	3.6	27.5	21	12.1	12.5	14.7	2.7	18	13.5	14.2	12.7	15.4	12.5	18.2	8.1
SrO									1.6	1.5	0.2									
ZnO	20	15.4	20.3	6.5	4.9	3.7	17.9	18	12.5	19.7	9.8	9.7	19.5	14.4	12	12.1	12.3	13.5	13	12.4
Fe <sub>2</sub> O <sub>3</sub>	0.1			0.6										0.5	0.3				0.3	
TiO <sub>2</sub>								1.3					2.2							

**TABLE 3 of U.S. Patent 6,274,971 converted**

	<mol%>																			
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
SiO <sub>2</sub>	19.7	25.8	31.0	40.8	50.2	55.9	35.5	27.9	39.3	33.5	36.9	39.7	32.0	34.7	35.9	32.8	33.4	31.8	36.1	33.5
Al <sub>2</sub> O <sub>3</sub>	1.5	0.1	1.2	0.8	0.0	0.0	1.4	2.9	1.4	0.0	0.0	0.2	0.0	0.7	1.1	0.8	0.1	0.6	1.1	0.6
B <sub>2</sub> O <sub>3</sub>	42.8	38.8	32.9	39.0	33.5	29.1	16.4	28.5	29.5	33.0	36.9	40.9	34.0	37.2	35.1	35.2	34.0	31.4	33.1	29.8
Na <sub>2</sub> O	3.8	7.6	5.4	6.8	6.7	7.0	7.5	6.3	6.2	4.9	5.7	6.9	2.7	3.6	5.2	0.0	9.6	11.2		11.9
K <sub>2</sub> O	3.5	2.9	4.9	2.6	2.7	2.2	5.9	4.3	5.3	3.3	4.3	2.9	1.7	3.6	4.5	5.0	4.0	4.8	4.2	7.6
Li <sub>2</sub> O																9.6			4.2	
CaO			0.7	0.0	1.1	1.2	0.6									0.3	0.1	2.1		1.7
BaO	9.2	10.1	5.3	3.8	1.8	1.5	14.7	11.0	5.8	6.1	7.1	1.2	9.0	6.6	6.9	5.8	7.5	6.0	8.9	3.8
SrO									1.1	1.1	0.1									
ZnO	19.5	14.7	18.6	5.6	4.0	3.0	18.1	17.7	11.4	18.1	8.9	8.2	18.5	13.2	11.0	10.5	11.3	12.2	12.0	11.0
Fe <sub>2</sub> O <sub>3</sub>				0.6										0.2	0.3				0.3	
TiO <sub>2</sub>								1.3					2.1							

**APPENDIX 1**

Claim(s)	Rejection	Basis
1	provisional obviousness-type double patenting	claim 1 of co-pending application 09/867,759 (the '759 application) and  claim 21 of co-pending application 09/794,151 (the '151 application)
2	provisional obviousness-type double patenting	claims 1 and 7 of the '759 application
3	provisional obviousness-type double patenting	claims 1 and 10 of the '759 application
5	provisional obviousness-type double patenting	claims 1 and 13 of the '759 application
6	provisional obviousness-type double patenting	claims 1, 13, 16, and 19 of the '759 application, and claims 21 and 26 of the '151 application
8	provisional obviousness-type double patenting	claims 1 and 28 of the '759 application, and claim 21 and 28 of the '151 application
9	provisional obviousness-type double patenting	claims 1 and 31 of the '759 application, and claims 21 and 29 of the '151 application